

## ON THE LIFE-HISTORY OF *CERATODUS*.

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From the earliest times (1870) when *Ceratodus* (*Epiceratodus forsteri* Krefft) became known to the scientific world and was described by Gerhard Krefft of the Australian Museum, no one, not even the aborigines, was able to find the very young fish; individuals even six pounds in weight were scarce and only very rarely indeed were specimens two or three pounds in weight taken. The usual weight of fish caught in nets and by line was from sixteen to thirty pounds; larger fish are so powerful in the water that nets do not hold them and, when hooked, they cannot be landed, as the fleshy lips tear away. Few people have seen larger specimens than thirty pounds, yet it has been often stated that the fish grows up to eighty pounds in weight and five feet in length. Fish six pounds in weight are not sexually mature.

The conditions for the favourable propagation of *Ceratodus* no longer occur.

Fertile spawn is produced in large quantities every season, during August and September; it is the annual festival for fish, particularly large jew-fish (*Tandanus tandanus*) and for wood ducks (*Chenonetta jubata*); these animals eat up every particle of spawn they can find, and any that does escape them is devoured by prawns, insect larvae and little fish.

*Ceratodus* is the living representative of that ancient group of fishes which swarmed the palaeozoic seas, but just why it survived in the Burnett and Mary Rivers is hard to conjecture. It is possible that a few individuals remain in other rivers in Queensland, but owing to their rarity have not been noticed. The late Thomas Illidge wrote a good article on *Ceratodus*, published in the *Brisbane Courier*, August 6th, 1902, in which he stated that he had, whilst living at Gayndah, on the Burnett River, for ten years tried by every possible means to find small forms of *Ceratodus*, but without success; the smallest he did find was fifteen inches in length. My experience, lasting over seventeen years, has been similar to that of Illidge and gives the impression that there are now no young fish growing up or only an odd one or two; in other words *Ceratodus* is nearing extinction.

In the inland seas which existed in Queensland the conditions for *Ceratodus* were favourable; possibly they were shallow seas with abundance of water plants, but without the enemies which now occur in the freshwater rivers. When the seas dried up, *Ceratodus* had to adapt itself to new and less suitable conditions. Another theory that might be advanced is that in ancient times *Ceratodus* had good eyesight, which it has gradually lost, for at the present

day it is practically blind. That the fish is now almost blind can be demonstrated on old specimens as well as on the larval forms, for one may move a straw about closer even than one inch from the eyes without disturbing it. The hearing too is less acute than in other fishes.

Professor Semon, in 1892, with the assistance of Mrs. McCord, of Coonambula Station on the Burnett, reared *Ceratodus* larvae up to ten weeks, and afterwards the late Thos. Illidge likewise reared them to ten weeks and, during the last year he resided at Gayndah, succeeded in carrying a few past their critical period and up to eight months, which specimens he then preserved.

In 1910, the year I arrived on the Burnett, I reared a few up to ten weeks, when they sickened and died; subsequently every year I reared a number, sometimes as many as five hundred, but only two, out of the many thousand hatched during seventeen years, lived through the critical three months stage. If they can be kept alive over three months, they thrive well afterwards.

How to tide the young fish over this critical stage was the problem which had to be solved, and which until recently seemed insoluble.

It was generally considered that the fish was constitutionally weak from in-breeding. Many scientists, to whom I appealed for suggestions as to how to carry the fish over its critical period, were unanimous in considering that it was entirely a question of the proper food. That idea has been probed thoroughly. The larval *Ceratodus* just hatched, which occurs four or five weeks after oviposition, still has some yolk left, but this is used up during the first week; the little fish thrives well for a time, feeding on minute algae. *Tandanus* larvae have been reared in conjunction with *Ceratodus* and were alive and growing well after all the *Ceratodus* were dead, which proved that the food supply was not at fault.

At one time it was considered that the non-success in rearing *Ceratodus* larvae past their critical period was the want of a sufficiently large body of water. Professor Edgeworth, of the University of Bristol, was anxious to secure larval *Ceratodus* for study of the laryngeal muscles; the University sent me a glass aquarium 34 in.  $\times$  17 in.  $\times$  17 in., but year after year any larval *Ceratodus* introduced into it succumbed within a week.

Although this aquarium has not been of use in rearing *Ceratodus* larvae, yet it has served a useful purpose in that it put me on the track to solve the mystery.

I used it as an ordinary aquarium set up with water weeds and different little fish from the river; algae grew on the glass; frog spawn and young tadpoles were introduced in the hope that they would keep the glass clean, but to my astonishment they only lived a week; it was soon found out that the water was too deep for them. As this was so for frogs, might it not be the same for *Ceratodus* larvae? Eventually half an inch of water was found to be the best depth for the young *Ceratodus*, but quite recently a further discovery was made in that the larvae were observed to rest with their heads out of water and at times with the whole body out of water; when disturbed they will go right out of water and rest there for a while before wriggling back again.

The cardinal points in rearing larval *Ceratodus* are: firstly, to keep them in a very confined space supplied with abundance of food; they seem to be blind and when the food is scattered about they do not find sufficient; and secondly, to keep the depth of water as near half an inch as possible, and to have a diminutive sand-bank on which the fish can rest out of water.

*Technique of rearing larval Ceratodus.*

Early in August search for suitable spawning grounds on the river in deep lagoons known to harbour *Ceratodus*. Look in the shallowest parts of the lagoon close to the water's edge for water weeds, particularly *Vallisneria* and *Hydrilla*, although, if there are none of these plants, the fish will then spawn in *Nitella* beds, of which there will almost certainly be some; *Nitella* is the first plant to appear after a flood.

It is usually the middle of August when the first spawning occurs.

The eggs are scooped out with a strong landing net with mosquito-net bag; scrape hard on the bottom through the weeds. Put the eggs immediately into a pickle-bottle full of water, the bottle being inserted into a large jam tin or billy-can and kept from direct sunlight.

On reaching home transfer each egg to a bottle of water to itself—four ounce medicine bottles are suitable; if the eggs are kept together and one dies, they all die. The bottle should be kept in a dark place and need not be examined again for four or five weeks. When hatching occurs, the water and fish are poured out into a glass cell or other aquarium and a quantity of alga (fine *Spirogyra* if possible) added, the cell being shaded from too much light.

The larvae do quite well for a few weeks in glass jars with about two inches of water, after which they must be transferred to shallow dishes; 12 in. × 9 in. enamel pie-dishes answer well. The water must not exceed half an inch in depth; at one end of the dish place a couple of handfuls of sand to make a sloping bank. Add abundance of algae of different kinds, also mosquito larvae, and arrange a small slate to shade one end. Float the pie-dish in a larger dish and put the whole in a shaded place. It is advisable to cover the whole with mosquito-net to exclude frogs.

Every second day drop in a small piece of hard-boiled yolk of egg, a piece the size of a grain of wheat well rubbed up with a pinch of pollard; I think the fish eat this mixture, but at any rate it serves as food for the mosquito larvae and does not pollute the water. As evaporation occurs a little water must be carefully added, also more algae and mosquito larvae.

The fish do well in the pie-dishes until they are four months old, when they can be transferred to large aquaria with deeper water, but it is advisable so to arrange the bottom as to give varying depths from half an inch to six inches; the aquaria should be shaded in places with slates and should have abundance of *Vallisneria*.

I once reared a *Ceratodus* until it was two years old in a half ship's iron tank, when a hail storm occurred, filling the aquarium with ice; the fish appeared to be dying, so was preserved. To avoid any such occurrence the aquaria should be under cover.

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